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Georgia Southern Proposes New Computational Methods of Computing Confidence Bounds

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A collaborative study including Dr. Daniel Linder, assistant professor of biostatistics at the Jiann-Ping Hsu College of Public Health Georgia Southern University proposes new [computational methods of computing confidence bounds for the least-squares estimates](#) (LSEs) of rate constants in mass action biochemical reaction network and stochastic epidemic models. Such LSEs are obtained by fitting the set of deterministic ordinary differential equations (ODEs), corresponding to the large-volume limit of a reaction network, to network's partially observed trajectory treated as a continuous-time, pure jump Markov process. In the large-volume limit the LSEs are asymptotically Gaussian, but their limiting covariance structure is complicated since it is described by a set of nonlinear ODEs which are often ill-conditioned and numerically unstable. The current paper considers two bootstrap Monte-Carlo procedures, based on the diffusion and linear noise approximations for pure jump processes, which allow one to avoid solving the limiting covariance ODEs.

The results are illustrated with both in-silico and real data examples from the LINE 1 gene retrotranscription model and compared with those obtained using other methods.

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